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Introduction to Organic Farming

By J. I. Rodale

Editor of ORGANIC FARMING AND GARDENING

THE subject of organic farming is new to the majority of farmers. In this country it has been taken up on a limited scale, only in the last few years. In Europe, —England, Denmark, Switzerland and Germany especially— it has been in use on a more extensive scale for many years and its advantages have been tested widely. There are two methods that have been used, the Bio-Dynamic system and the Indore method, the latter receiving its name from the city of Indore in India where it was first tried by Sir Albert Howard. They both have one thing in common, which is that they frown on the use of so-called chemical fertilizers.

A detailed description of the Indore method of composting is given elsewhere in this magazine as is also the Bio-Dynamic system. What is claimed roughly for these organic methods of farming is that they increase the fertility of the soil, produce much better tasting crops, crops that are healthier for man and beast, reduce weeds, do away with the necessity of using poisonous sprays, improve the mechanical structure of the soil, enable it to retain moisture, and

reduce soil erosion, etc.

Sir Albert Howard, advocate of the Indore method of farming has said that "artificial manures (chemicals) lead inevitably to artificial nutrition, artificial animals, and finally to artificial men and women."

A few years ago in an English health magazine published in London there appeared a brief account of an experiment in the feeding of children which had a tremendous significance in connection with bodily resistance to disease. There were two groups of children. One group was fed on vegetables raised by ordinary methods with the liberal use of chemical fertilizers. The second ate vegetables grown by the use of compost fertilizer only, containing no chemicals.

The latter children enjoyed a singular immunity to colds whereas the former suffered from the regular, normal condition as to colds, coughs, etc.

Compost fertilizer is a purely organic material as distinguished from mineral fertilizers (chemicals). It is made by mixing manure with such plant materials as weeds, leaves, grass clippings, etc. By

a natural process, decay takes place and the resultant material, which has a rich woodsy brown color, goes back into the land to enrich it in a manner that the roots of plants can appreciate and absorb, as against unnatural chemicals which the roots cannot as efficiently work with.

This was the first time that I had ever heard a question raised as to the methods used in raising crops insofar as it affected our health. Having read, extensively over a long period of time in medical journals, health magazines and books and never having seen this point discussed, it reacted as something of overwhelming importance.

I have obtained and read several times over Sir Albert Howard's book entitled "An agricultural testament" which treats the entire subject in adequate detail. (Price \$4.50).

The Bio-Dynamic method is described in a book called "Bio-Dynamic, Farming and Gardening by Dr. Ehrenfried Pfeiffer.

Since July, 1941, we have been making compost heaps, using manure obtained from a herd of 20 steers. There is no question that the making of

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these heaps means extra labor, but it will be shown in the columns of this magazine that this extra work will be more than repaid by getting better crops and selling them at higher prices. The use of organic materials exclusively means greater profits for the farmer.

Plant growth depends on a bacteriological process in the soil and in this process there is a certain relationship or co-operation between bacteria and certain fungi called *mycorrhiza*. These two work as a team in feeding the organic matter of the soil to the roots. In the presence of artificial chemical fertilizers the efficiency of these bacteria and *mycorrhiza* is greatly reduced and the resultant food products do not have the fine taste of those raised with natural organic fertilizer materials, also called humus. In other words not only would we be much healthier if we ate food grown under the above-mentioned correct methods, but our farm animals, if fed on them would be healthier and the income we get through them would be higher.

Where much chemical fertilizers are used with insufficient application of organic substances the soil is gradually becoming hard-packed and the earthworms which nature put there for a well-defined purpose are being killed off. By boring in the earth these tiny creatures produce openings which help in getting oxygen into the soil. But their most important duty is actually to swallow earth, mix it with matter from their digestive process and excrete one of the finest natural fertilizer materials ever made. Many soils today are almost barren of worms because of the constant dumping into the

soil of artificial chemical fertilizers. By the use of humus, or the natural organic fertilizers, the amount of earthworms in the soil is greatly increased because they can live and multiply in this element which is natural for them.

It is rather paradoxical that the medical profession and its thousands of scientific workers are spending so much time measuring the amount of vitamins in various food products and formulating interesting principles regarding their application to health problems, yet disregarding the basis or foundation of the food products. Plants are not like money for example. A one dollar bill always means 100 cents. But two different pea-pods each representing the same weight do not have the same amount of vitamins.

One of these fine days the public is going to wake up and will pay for eggs, meats, vegetables, etc., according to how they were produced. A substantial premium will be paid for high quality products such as those raised by organic methods. It is possible that if you feed chickens on home raised feeds produced without the use of chemical fertilizers, instead of getting 30 or 40c a dozen your eggs will command 50 or 60c a dozen. The better-earning class of the public will pay a high price if they can be shown its value, and that they will save on doctor bills.

Dr. Alexis Carrel, in his world-famous book "*Man the Unknown*," wrote:

"Chemical fertilizers, by increasing the abundance of crops without replacing the exhausted elements of the soils, have contributed indirectly to change the nutritive value of

our cereal grains and our vegetables."

It has been proven that not only may food crops be grown without the aid of chemical fertilizers, but that when natural organic fertilizers are used, the food thus grown not only produces greater body resistance to disease when eaten by either man or animal, but the taste of the food is by far more delicious and natural.

In New Zealand practically all the farms are treated with chemical fertilizers. A few years ago, the *Lancet*, famous London medical magazine said, "In 1936 Dr. G. B. Chapman, of the Physical and Mental Welfare Society of New Zealand, persuaded the authorities of a boys' school hostel to grow their fruit and vegetables on soils treated with humus. This has since been done, and a striking improvement is reported in general health and physique, particularly as regards freedom from infections, alimentary upsets and dental caries."

In India, the Hunzas of the north have been found to have the best health and physique of the entire country. They are a "hardy, agile, and vigorous people," says Sir Albert Howard. "They have marvelous agility and endurance, good temper and cheerfulness. These men think nothing of covering the 60 miles to Gilgit in one stretch, doing their business and then returning. . . health and physique enjoyed by the Hunza hillmen appears to be due to the efficiency of their ancient system of farming." It was found that they return to the soil all human, animal, and vegetable wastes after being made into compost heaps as described earlier in this article.

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Chemicals do not enter into their farming formula.

In overpopulated China, where the soil is literally "worked to death," and land is so precious, this method of using compost heaps has been in use for over five thousand years. The full advantage in China, however, cannot be secured on account of overpopulation in the first place and secondly because of frequent crop failures due to insufficient rainfall. Had chemical fertilizers been extensively used there over a period of not thousands, but only hundreds of years, China today would be a barren wasteland.

The dust storms in mid-western United States are partly due to the lack of organic humus in the soil. The humus that the farmer can make in the form of compost heaps, after being worked into the soil will improve the moisture retaining capacity of the earth. That is one of the very important aspects of this method of fertilization. The earth will retain moisture during long periods of drouth. Ground which is over-

chemicalized, as in the dust-bowl regions, becomes hard packed and powdery, and is bound to become worthless eventually.

Unless more organic material is returned to the soil, the future of this country looks somewhat disheartening, because industry and prosperity are closely bound to and dependent upon agriculture. It is said that the decline of Rome was due to a deterioration of its crop lands. There are many other examples in History where carelessness in the handling of the soil resulted in the practical extinction of races, or reduction to a low status.

According to Sir Albert Howard in his *Agricultural Testament*:

At Marden Park in Surrey, England, Sir Bernard Grennwell has found that a change over to a ration of fresh home-grown food (raised on soil manured with humus) fed to poultry and pigs has been followed by three important results: (1) the infantile mortality has to all intents and purposes disappeared; (2) the general

health and well-being of the live stock has markedly improved; (3) a reduction of about 10 per cent in the ration has been obtained because such home-grown produce possesses an extra-satisfying power.

At a large preparatory school near London, at which both boarders and day-boys are educated, the change over from vegetables, grown with artificial manures, to produce grown on the same land with Indore compost has been accompanied by results of considerable interest to parents and to the medical profession. Formerly, in the days when artificials (chemicals) were used, cases of colds, measles, and scarlet fever used to run through the school. Now they tend to be confined to the single case imported from outside. Further, the taste and quality of the vegetables have definitely improved since they were raised with humus.

(Another article in this series will appear next month.)

Tobacco and Chemical Fertilizers

SOME experiments made by the Agricultural Experiment Station of the University of Wisconsin at Madison, Wisconsin, which were written up in their Research Bulletin 40, dated August, 1941 clearly show that the use of chemical fertilizer in growing tobacco reduces its

quality. The scoring system used in these tests took into consideration the color and coherence of the ash, the evenness and rate of burn, the carbon zone of the burn and its fire-holding qualities.

This was not merely a "flash-in-the-pan" single experiment, but consumed 10 successive

years. The table shows the general results obtained:

	Score
Manure 40 tons	85
Manure 20 tons	81
Manure 10 tons plus 500 lbs. 2-10-8	79
Straw 5 tons	80
2-10-8 (2000 lbs.)	76
None	77

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The report says that . . .," the cigar-burn from the manure plot was distinctly improved, as expressed particularly in the evenness of the burn and reduced flakiness of the ash, as well as in the better aroma which is not taken into account in the score. This may be accounted for by the fact that flakiness is not correlated with leaf-burn or potash content, but rather with calcium and magnesium content of the leaf (3), which is in turn evidently modified by the organic mat-

ter used as fertilizer. Muriate of potash alone resulted in cigars which were inferior in cigar-burn to controls without fertilization, a result which may be expected from the leaf-burn shown in Table 12 and from previous results of others on the effect of muriate of potash on leaf-burn."

We must bear in mind, although the best returns were obtained with a liberal amount of manure, that even better results might have been

expected had this manure been composted with plant material, or had it been treated according to bio-dynamic methods. We assume, as nothing about it is mentioned in the experiment, that raw manure was used. It stands to reason that "finished" compost or humus would have more readily been absorbed in the soil. On the other hand, raw manure when first applied to the soil actually interferes with the growing process of plants and takes something out of the soil.

The Indore Method of Composting

By Sir Albert Howard

THE following instructions for the making and management of the compost heap follow the method known as the Indore Process. The method has the merit that not only is it truly economical, in that "waste" materials are salvaged, but also that weed seeds and harmful insects and fungi are destroyed and vegetable grown with its use are disease-resistant and of unequaled food value.

Materials

The first requirement is "organic wastes," that is, plant residues: weeds, leaves, old straw and hay, bracken, reeds, seaweed, hedge trimmings, etc. Paper, worn-out clothing, leather and sacking can also be added after previous soaking in water. All green material should be withered. Hard woody material should be cut into short lengths and crushed where possible by, for example, wheel traffic. Anything very resistant (lignins or leather) can be transferred from heap to heap if the first is not enough to break it down.

The second requirement for the compost heap is animal manure, from horses, cattle, sheep, pigs, rabbits or poultry.

The third requirement is earth,

if possible with lime, as ground limestone or chalk, wood ash, or even freshly riddled coal ash, or preferably a mixture of all. The earth, etc., is needed as a neutralizing agent.

The fourth requirement is water. In general rain will supply this need (in fact it may be said that protection from rain is more important in this country than the provision of water, although there are occasions when it must be added). The heap must not be too wet, the consistency of a squeezed sponge being aimed at. Liquid manure (for instance drainage from a pig cote) is of the very highest value.

During the early stages of decomposition air is required in large quantities by the fungi and germs in the heap. This is got by diffusion from the atmosphere, so the heap must be made loose. Later, after the fungous stage is over and the material has crumbled and darkened, the heap has reached a stage where the fermentation goes on without air. The germs obtain their oxygen from the decomposing material itself.

Making the Compost Heap

1. COMPOSITION OF THE HEAP.

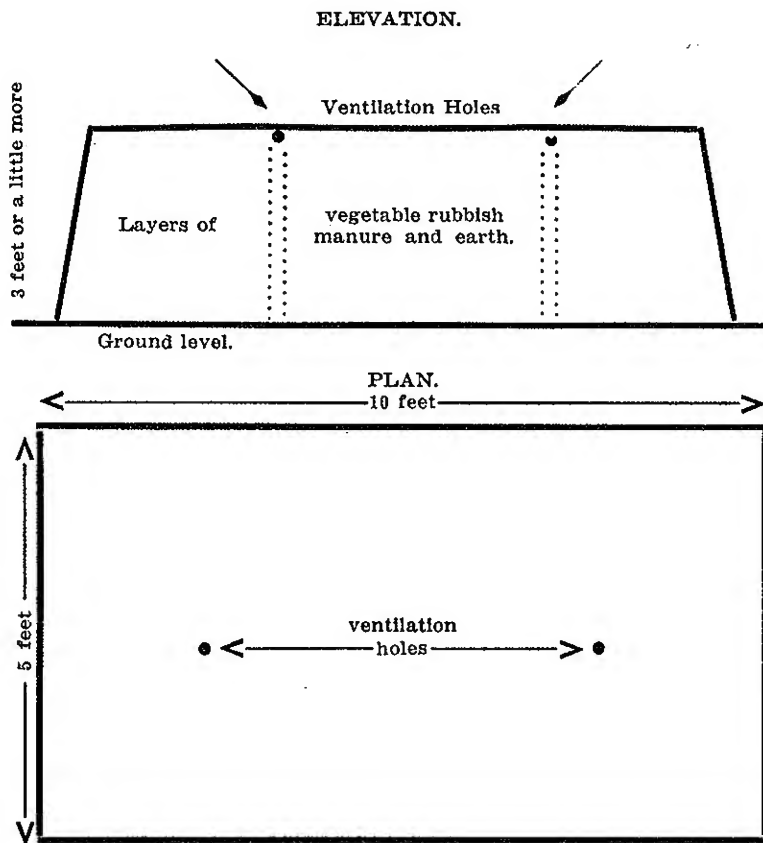
Make square or oblong heaps

upon earth, NOT concrete. If possible a bottom should be made in a similar manner to that of a haystack. Hedge trimmings, bush fruit prunings or other materials which will act as an open base are suitable. This assists aeration. On this base the heap is built. It consists of a horizontal layer of about 6 inches of mixed organic wastes followed by a thin layer, about 2 inches, of animal manure, followed in its turn by a good sprinkling of earth containing, where these are available, wood-ashes and lime preferably in the form of chalk or ground limestone. This three-layer sandwich, the wastes, the manure, the earth and ash is repeated until a height of from 4 to 5 feet is reached. (It will sink later.) The final layer of manure should be about twice the previous thickness and the final sprinkling of earth should completely cover the manure.

In districts of heavy rainfall it is advisable to arrange for the finishing layers to form a double slope.

In most districts of England a temporary covering is ESSENTIAL to protect the heap against excessive rain. Boughs or poles should be laid across the heap to raise the covering.

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2. SIZE OF THE HEAP

The minimum size for a heap is 5 ft. x 5 ft. high. With any side smaller the ratio of cooling surface to volume is too great. When making small heaps it is better to build the second up against the first and so on. The heat is then conserved. It can be planned so that the turnings, referred to later, follow each other and the benefits of a larger heap are thus maintained.

Space must be allowed for turning the heap. Two turns are required to complete the process.

3. SUPPLY OF AIR,

It is very important that the heap should be made as loose as possible in order to permit copious aeration, and care should be taken not to step on the heap whilst building.

It has been found that in this country aeration can be greatly assisted by making in the heap vertical holes by means of a rod or crowbar. Some people stand a rod upright first and make the heap around it. The holes can be made

4 inches or 6 inches wide by pushing the rod to and fro. The holes should be 3 feet apart.

4. FIRST TURN.

An intense fermentation sets in during 3 weeks and the temperature of the heap rises to about 150 deg. F. The material inside the heap turns white due to the development of fungus growth.

At the end of 3 or 4 weeks the heap is turned from one end on to a new site, care being taken to bring the outside to the inside of the re-made heap. Holes should again be bored in the turned heap.

When turning for the first time, vertical slices should be cut, after the manner of cutting bread, of about 9 inches to 1 foot by means of a fork.

5. SECOND TURN.

The temperature which will fall towards the end of the first three weeks again rises. Within ten days of the first turn the material starts

to crumble and darken. *Bacteria* now take a leading share in the process.

About 5 weeks after the heap was originally made it is turned a second time, again the outside is brought to the inside and, where necessary, protection from rain is given. No holes are required after the second turn. A spade should be used to cut the heap at the second turn, the slices being about 6 inches wide.

6. COMPLETION, POSITION OF HEAP, AND GENERAL MANAGEMENT.

Three months after the process began the material is ready for application to the land. It consists of a finely divided product of which about 80 per cent will pass through a sieve of six meshes to the inch.

Protection against excessive rain has already been mentioned. The opposite possibility of dryness must be watched for and if rain be insufficient, water must be added. This must not be sluiced on to the heap with a bucket but sprayed either by a hose with a nozzle or from a can with a rose. If water be added at the time of turning this rule does not hold and water from a bucket may be sprinkled on to the material cut from the heap before it is re-made into the new heap. This method should, be used **WITH DISCRETION** and the material thoroughly mixed before it is added to the re-made heap in order to distribute the moisture. It has already been mentioned that the material should have sufficient moisture to give it the consistency of a squeezed sponge. That is the guide to which the maker should work. It is impossible to lay down a hard and fast rule concerning either the protection of the heap from rain or the addition of water in the absence of rain. The heap has life and must be looked after like all living things.

If a sheltered site can be chosen facing south and with a wind-break

from the north, so much the better. This applies particularly where the heaps are only five to six feet square, and for these smaller heaps,

where possible, protection should be given on three sides by means of walls or hedges; but the heap must never be banked up against a wall.

The system by which mutual protection is given by old and new heaps should also be used wherever possible.

Introduction to the Bio-Dynamic Techniques

Issued by the Bio-Dynamic Farming and Gardening Association.
Kimberton Farms, Kimberton, Pa.

THERE are three fundamental steps in the use of the bio-dynamic method of agriculture:

1. The careful handling of animal manures and plant compost material, using a simple but effective technique of piling (which has the effect of speeding up the rotting of these materials while conserving the fertilizer values) and the insertion into the piles at the time of setting up of certain pre-rotted plant materials in drug form which stimulate bacterial activity in the pile and result in quicker rotting and enhanced fertilizer value of the manures and composts.

2. The use of these prepared organic fertilizers along with certain "fertilizer aids" consisting of two sprays, one of which, made from a specially rotted cow manure, is put on the ground at time of planting and which stimulates and regulates humus formation in the soil, and particularly aids the root development of the plants, and the other of which, made from a powdered quartz, is sprayed on the plants when they are in leaf but not in blossom and which stimulates the plant's assimilative capacity and results particularly in greater quality and flavor.

3. The practical use, rather than mere theoretical acceptance of healthy soil-conserving crop successions suited to the particular farm in question (condition of soil etc., and also type of market avail-

able for produce) and involving the planting of legumes at frequent intervals in the succession—at least once in four years.

The care of orchards along certain sound biological lines is also among the fundamental procedures, the following or the neglect of which determines whether or not a place may be defined as a bio-dynamic farm.

Other measures such as the use of protective planting strips, the combatting of pests by biological means, the development of home-grown feed for cattle in place of concentrate feeds, etc., are all bio-dynamic measures that are up to the initiative of the individual farmer, and, while essential and important are given emphasis according to the individual situation.

The method also may be correctly considered from the point of view that the carrying out of the procedures referred to above, results in a tremendous stimulation, in an organic, healthy way, of the micro-organisms in the soil, the earthworms and soil-bacteria. The necessity for these and their activity in humus formation and making the resources of the soil available to the plant is well-known, but it is frequently not taken into consideration that chemical fertilizing inhibits and even drives these out completely, in ratio to the intensity and length of time of the application.

A first step in applying the bio-dynamic method of agriculture originated by Dr. Rudolf Steiner, may be taken by using natural fertilizers prepared according to this system.

Compost piles, plant refuse, more or less casually heaped up and allowed to decay, are nothing new to agriculture. Similarly composted manure is a familiar thing. But bio-dynamic agriculture, which uses composts and composted manure to the exclusion of artificial fertilizers, places great emphasis on their method of preparation and the care taken in this. The value of such an emphasis, for the resultant fertilizers, has been demonstrated by comparative experiments.

The compost pile, which may include weeds, grass cuttings, all forms of plant discard (potato vines for example) miscellaneous kitchen garbage, dust from house cleaning, or any of those and similar ingredients, is set up according to the bio-dynamic method as follows:

A space thirteen feet square (or less) and at least partially shaded, is cleared of turf. If the ground is predominantly sandy, it is excavated to a depth of about six inches or less, and line that with an inch or two of loam. If you have a clay soil which is fairly well-balanced, no lining is needed, but an excavation of several inches in depth is nevertheless preferable.

SETTING UP THE PILE
The compost material is piled up

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evenly, not in clumps, and firmed down as much as possible during the piling. When it reaches the height of about one foot, it is sprinkled with a thin layer of powdered quicklime (unslaked lime), applied about as lightly as a dusting of sugar on powdered doughnuts. Then, a very thin layer of earth, not too raw or lifeless, should cover the lime. When the pile, oblong or square, but not allowed to become scraggly at the edges or irregular in height, has gone up another foot, the procedures with the lime and earth is repeated. For a very quick result one can pile the plant refuse in layers two fingers thick, sprinkle them with quicklime as above, add one finger of earth and repeat. Such a composting will result, under favorable conditions, in the production of a fine neutral humus in as short a time as three to four months.

Shrinkage in the pile is likely, but the less shrinkage the better. When it is possible to complete a pile almost at once, that is, when you have a lot of material, the pile is less likely to shrink. The stalks of perennial plants, used for compost, should be cut into small pieces in order to speed the rotting process and lessen shrinkage.

After the whole pile has reached

five or six feet in height, the biodynamic compost—preparations, known as 502-7 and consisting of specially prepared plant materials, are added. They are inserted in holes 16 to 24 inches in depth, and distributed spatially through the pile. The preparations are tamped down and the holes firmly closed over them. 502-506 are solid drugs. 507 is a liquid, eight to ten drops of which should be dissolved in a gallon of lukewarm water and stirred thoroughly for ten minutes. One-half of this liquid is poured into one of the holes in the compost pile, the other half is sprayed over the compost pile before covering it with earth. The sprinkling may be done with a whisk broom or a spraying can in which nothing but water has been used. The pile is then covered on top and sides with earth, with sods turned face downward or with peat moss. The preparations speed up the decay of the materials and enrich the resulting humus. This has been shown in repeated tests. The preparations should be in the pile for six to eight weeks at the very least, to show an effect. Longer than this is much better.

In completing the compost pile a sort of trough is formed in the top. This is for watering the piles which should be done once a week

except in times of heavy rain. Watering keeps the materials moist and prevents overheating and too swift decay. Rain water or brook water should be used and if available should include natural liquid cow manure or previously dissolved cow dung, in a proportion of one to ten. (Directions on preparing these so that their qualities are improved and they are practically odorless will be gladly furnished on request. Piles should also be regularly weeded. The inside of the pile should always have the inside moisture of a sponge which is still wet, although no more water can be wrung from it. If weather conditions and proper shading keep the pile at this state of moisture, additional watering is not necessary. However, the liquid manure watering, if this is available, adds greatly to the fertilizer value of the resultant material.

After about three to four months, the covering should be removed and the pile completely turned over and re-covered. At this time the plant preparations may again be given, although this latter is not absolutely essential. In about ten months from setting up, depending upon the materials used, the pile should be a rich humus, ready for use in the garden.

Vegetable Mold and Earthworms

By Charles Darwin

A condensed version of the famous book published in 1882
with comments by J. I. Rodale

FIRST INSTALLMENT

THE vegetable mould (made by earthworms) is generally of a blackish color and a few inches in thickness. As I was led during many months to keep worms in pots filled with earth, I became interested in them and wished to learn how far they acted

consciously, and how much mental power they displayed.

Small fragments of burnt marl, cinders, etc., which had been thickly strewn over the surface of several meadows, were found after a few years lying at the depth of some inches beneath the turf, but still

forming a layer. This apparent sinking of superficial bodies is due to the large quantity of fine earth continually brought up to the surface by worms, in the form of castings. These castings are sooner or later spread out, and cover up any object left on the surface. I was

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thus led to conclude that all the vegetable mould over the whole country has passed many times through, and will again pass many times through, the intestinal canals of worms.

Worms abound to an extraordinary degree in kitchen gardens where the soil is continually worked, though in such loose soil they generally deposit their castings in any open cavities or within their old burrows instead of on the surface. There are about twice as many worms in gardens as in cornfields.

Chapter I

Earth-worms abound in England. Their castings may be seen in extraordinary numbers on the common and chalk-downs, so as almost to cover the whole surface, where the soil is poor and the grass short and thin. But they are almost or quite as numerous in some of the London parks, where the grass grows well and the soil appears rich. Even on the same field worms are much more frequent in some places than in others, without any visible difference in the nature of the soil.

Beneath large trees few castings can be found during certain seasons of the year, and this is apparently due to the moisture having been sucked out of the ground by the innumerable roots of the trees; for such places may be seen covered with castings after the heavy autumnal rains. In a forest of tall and ancient beech-trees where the ground beneath was bare of all vegetation, not a single casting could be found over wide spaces, even during the autumn. Nevertheless, castings were abundant on some grass-covered glades and indentations which penetrated this forest.

Earth-worms must be considered as terrestrial animals, though they are still in one sense semi-aquatic. M. Perrier found that their exposure to the dry air of a room for only a single night was fatal to

them. On the other hand he kept several large worms alive for nearly four months, completely submerged in water. (Another investigator found that worms endured immersion for 15 to 20 days in summer, but that in winter they died when thus treated.) During the summer when the ground is dry they penetrate to a considerable depth and cease to work, as they do during the winter when the ground is frozen. Worms are nocturnal in their habits, and at night may be seen crawling about in large numbers, but usually with their tails still inserted in their burrows. By the expansion of this part of their bodies, and with the help of the short, slightly reflexed bristles, they hold so fast that they can seldom be dragged out of the ground without being torn into pieces.

During the day they remain in their burrows, except at the pairing season, when those which inhabit adjoining burrows expose the greater part of their bodies for an hour or two in the early morning. Sick individuals, which are generally affected by the parasitic larvae of a fly, must also be excepted, as they wander about during the day and die on the surface. After heavy rain succeeding dry weather, an astonishing number of dead worms may sometimes be seen lying on the ground. On one occasion the dead worms averaged one for every two and a half paces in length on a walk in Hyde Park, London, four paces in width. There were no less than 45 dead worms in one place in a length of 16 paces.

From the facts above given, it is not probable that these worms could have been drowned, and if they had been drowned they would have perished in their burrows. I believe that they were already sick, and that their deaths were merely hastened by the ground being flooded.

Worms have a habit of lying near the surface and this leads to their

destruction to an immense extent. Every morning during certain seasons of the year, the thrushes and blackbirds on all the lawns throughout the country draw out of their holes an astonishing number of worms. It is not probable that worms behave in this manner for the sake of breathing fresh air, for we have seen that they can live for a long time under water. I believe they lie near the surface for the sake of warmth, especially in the morning; and we shall see that they often coat the mouths of their burrows with leaves, apparently to prevent their bodies from coming into close contact with the cold, damp earth. It is said that they completely close their burrows during the winter.

(To be continued)

Notes By J. I. Rodale:

What is the significance of what we have read thus far—?

1. The earth-worm throws up castings and does so in quite substantial amounts.

2. Earth-worms are delicate creatures becoming easily affected by the disturbance of the moisture balance in the soil. In the summer when the ground becomes exceptionally dry they work down to lower levels and cease to work. In the study of the use of organic fertilizer materials you will find that the increase of humus in the soil improves the mechanical structure and enables the ground to retain much moisture, thus preventing such a dry condition from occurring and thus encouraging the worms to continue working at a time when they have ceased to do so on other drier lands.

3. It is shown also that sick worms, that have been affected by the parasitic larvae of a fly wander about during the day and die on the surface. How about the chemical action of artificial fertilizers on worms? We will discuss that later.

Letters From Readers

NOTE: These letters came in response to a series of articles which ran in a magazine called Health Guide, which is no longer being published.

THE first is from Tedford Dennis, a Chiropractor of Madrid, Iowa. He says:

Regarding results from using compost I am most enthusiastic on two counts. The third, the matter of its effects on health, I haven't had time to check well, but I am very hopeful. As to yields, I used some compost on Small Red "wine plant" (Strawberry, rhubarb) and it has grown into stalks as large as my wrist (2½ in.) which had just as good or better flavor as when it was tiny. I used some compost water on foliage plants last winter and they grew to be giants. My radishes were much more tender and sweet than my neighbor's planted at the same time. Root crops seem to respond better than above the ground ones, or the differences are more easily discernible.

One of the great futures for compost is in the orchard business. The practice of spraying to raise sound fruit is overdone. I believe using properly made compost in the orchard should entirely eliminate the necessity of spraying. Of course, the health building factor is the real "nub" back of substituting compost for chemical fertilizers, and doing the thing Nature's Way.

The next one is from R. Gaston Terasmi of the Terasmi Syndicate of Fort Worth, Texas:

The writer has just finished reading your second article pertaining to chemical fertilization of farms. Both articles are most enlightening and I wish to compliment you on your theme.

Undoubtedly something should be done about devitalized foods of

all kinds. I believe the human race lives but a portion of it's allotted time due to nutritional deficiencies.

You suggest that your readers write to congressmen, tell their farmer acquaintances of the facts you have so clearly stated, and otherwise encourage correct field fertilization. I think we should go further than that.

I have purchased ten copies of your magazine and am mailing them to congressmen. I am also mailing a copy to the editor of the Fort Worth Star Telegram. In all instances I folded the copies open with your valuable message clearly marked.

The following is a letter from a pharmacist, Mr. John Finkle of Detroit, Michigan:

I read the article on healthy soil (natural) and figured the one article was worth more than what I can ever pay.

My story is a long one, and I'll not bother you with that except that I am a druggist and was a very sick man, but have myself up to date enough so that I can do a good days work at age of 51 years (thru natural methods).

I was forced to study and research to save my own health, and can see now that the healthy soil as you mention (natural) from where I get my foods balance is where I have been mislead.

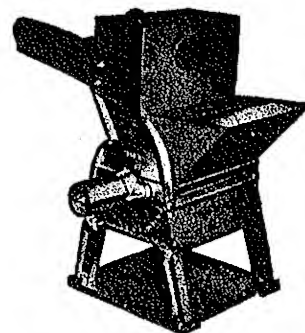
Here is a fine letter from Jim Allen of West Plains, Missouri:

I have been reading your articles about changing our farm methods and am heartily in accord with your statements.

I have a small farm here and am using the Oliver earth-worms and Ehrenfried Pfeiffer's compost method.

The neighbors think I am crazy

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ORGANIC FARMING AND GARDENING

but not for long I think because my crops are beginning to show up so much better than theirs that they are beginning to think maybe there is something to it.

So please keep up the good work of informing the public as the farmer will grow what the public demands.

We would like to quote from a letter written to Sir Albert Howard by Lady Eve Balfour of New Bells Farm, in Sussex England, dated Oct. 9th, 1940:

"People have no right to dismiss summarily a theory which they have made no effort to prove, when all those who have, are convinced.

I am nearly sure that I could pick out by flavor tomatoes, and many other things, grown with compost: and as to the pest resisting properties, I have had a most interesting demonstration of that here this year."

Speaking of her "six acres of market garden crops, cabbage, cauliflower, savoy, sprouts, etc." She says: "You know what a difficult season it has been for that class of crop, what with the drought, the fly, and the caterpillar.

My seedlings were grown on fertile soil, and were planted out on the ridge, compost being first put under the ridges. The weather was dry when they were put out, and in a short time all the plants were badly attacked by, first fly, and then caterpillar. I thought I had lost the whole crop; but I did nothing about it. In a few weeks, when the roots reached the compost, the plants began to recover, and, despite no rain, they not only grew well, but began to master the pests. About six weeks ago you could see, side by side, the completely recovered and the partially recovered and a few still badly attacked. Now, you would hardly believe that there had been a caterpillar or a fly in the field. My buyer says they are the cleanest greens he has seen anywhere this year. The flavor is su-

perb, and the color has been good throughout. He himself has lost *all* his cauliflowers and most of his cabbages; and has spent a fortune on sprays and insecticides. Result: he is the latest convert to compost. I have often grown these crops on farmyard manure without artificials; but, even if otherwise healthy, they have always before been bothered with fly in a dry season.

What interests me so particularly about this experience is that the crop was *attacked* and *recovered*, without any treatment. I find this more impressive than if they had not been attacked.

Always yours sincerely,

EVE BALFOUR.

P.S.—I forgot to say that I also have an absolutely healthy crop of onions grown with compost. This is also unique this year round here.

In reading your article in the April issue of Fact Digest on "Are Food Crops Fit for Human Consumption" several questions came to my mind. I believe it is an established fact that humus is one of the best fertilizers and is one of the components of the soil that is most deficient. However I am lost in trying to find a logical explanation why crops grown on soils with chemical fertilization do not nourish animals as well as soils without chemical fertilization. It is true that the common chemicals that are applied to the soil are not a perfect food for the plant and that when applied without proper supplemental practices may be harmful to the soil, but it is also true that when applied scientifically in the proper proportions to meet the deficiencies of the soil in the needed elements together with good farming practices such as green manuring, composting, proper cultivation, etc., they increase soil productivity and plant nutrition.

Organic matter and humus are very essential constituents of the soil but when supplemented with chemical fertilizer replacing the deficient elements the soil is more productive. The impression was received in reading your article that chemical fertilizers or mineral elements tend to make barren waste lands. I see no justification for this when applied in the logical manner. What conclusive evidence can be offered that humus increases the nutritive value of plants? Why should it? Are there certain hormones in the organic matter that the plant and animal life have to have in order to grow? Could this be a logical explanation why humus ical fertilizers down the hill. They are necessary for maximum productivity and very helpful when properly applied.

Yours very truly,

Herbert E. Parker,
Knoxville, Tenn.

Dear Mr. Parker:

There are several answers to your questions. The first is that the use of chemical fertilizers tends to kill off the earthworms and otherwise reduces their beneficial activities in the soil. Without earthworms the soil might as well be considered "barren waste lands." We are running as a series a condensed version of Charles Darwin's book on the earthworm which shows how essential it is that the earth teem with these industrious creatures. All the advocates of the use of chemical fertilizers overlook the importance of the earthworm in nature's scheme of things, how he aerates the soil and actually eats it to throw it off as castings which enrich the soil immeasurably.

Another practice which is helping to kill off the earthworm is spraying of poisonous materials on trees and ground crops. The powerful arsenics and other toxic sub-

ORGANIC FARMING AND GARDENING

stances that are used are slowly but surely killing off the earthworm population. To go a step further, experiments that were made at the Research Laboratory at Dornach in Switzerland showed that earthworms did not like soil saturated with artificial fertilizer and if given an opportunity chose earth fertilized with bio-dynamic compost, in preference even to soil that was not fertilized at all.

The second point is what is known as the "mycorrhizal association," which has been discovered by Sir Albert Howard and so well explained in his book, "An Agricultural Testament." The mycorrhiza and the root carry on a joint life together. "At the end of the partnership," says Sir Albert, "the root consumes the fungus (mycorrhiza) and in this manner is able to absorb the carbohydrates and proteins which the fungus obtains partly from the humus in the soil. The mycorrhizal association therefore is the living bridge by which a fertile soil (one rich in humus) and the crop are directly connected and by which food materials ready for immediate use can be transferred from soil to plant. How this association influences the work of the green leaf is one of the most interesting problems science has now to investigate. Is the effective syntheses of carbohydrates and proteins in the green leaf dependent on the digestion products of these soil fungi? It is more than probable that this must prove to be the case. Are these digestion products at the root of disease resistance and quality? It would appear so. If this is the case it would follow that on the efficiency of this mycorrhizal association the health and well-being of mankind must depend."

Sir Albert found that where plants were grown with artificial fertilizers the "mycorrhizal relationship was either absent or poorly developed. Where artificials were used on wornout tea, infection by

brownish hyphae of a *RHIZOCTONIA*-like fungus (often associated with mild parasitism) was noticed."

Again from the same book by Sir Albert Howard:

"Steps were taken during 1938 and 1939 to have the roots of sugarcane examined in order to test this point of view. Material was obtained from India, Louisiana, and Natal. In all cases the roots exhibited the mycorrhizal association. The large amount of material sent from Natal included canes grown with artificials only, with humus only, and with both. The results were illuminating. Humus is followed by the establishment of abundant mycorrhiza and the rapid digestion of the fungus by the roots of the cane. Artificials tend either to eliminate the association altogether or to prevent the digestion of the fungus by the roots of the cane. These results suggest that the change over from pen manure to artificials is at the root of the diseases of the cane and is the cause of the running out of the variety."

April 4, 1942.

May I ask if the medical profession has changed its attitude toward the use of human excrement for manure? Years ago in China I saw scores of cargoes of beautiful vegetables, including potatoes which could not have been touched directly by the night soil collected and used by the Chinese farmers, dumped into Hong Kong harbor on orders of Dr. Heiser of the Public Health Service. They were destined for Manila.

Personally I ate such vegetables cooked and uncooked for several years without bad effects. But the theory was that all sorts of disease germs were alive in these crops. The usual method in China was not to use compost but to mix manure both human and animal with water and to sprinkle it thick-

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ORGANIC FARMING AND GARDENING

ly on the growing plants. The gardens weren't fragrant, but the vegetables were luscious.

Would such methods be permissible in this country?

John H. Bacon.

There seems to be a difference of opinion in connection with the use of human excrement for manure. Sir Albert Howard of England, who is the sponsor of the Indore process for making compost heaps and who is doing a very valuable work, advises that it might be used provided it is composted and, no doubt, it would have to be very well composted. His book, "An Agricultural Testament," which we can secure for you and which would have to come from England, gives a great deal of information about this as well as the whole subject. We have ordered 20 copies and expect them in about three months. The price is \$4.50.

Dr. Ehrenfried Pfeiffer, who is at the head of the Bio-dynamic movement in this country, is against the use of human excrement for manure.

It is a highly controversial subject, but the writer believes that there is sufficient organic material at hand so that we do not have to use human excrement at present.

March 30, 1942.

I have a large supply of sediment in a creek that crosses my farm. Most of this sediment is sewage from Johnson City. The creek runs about three miles before it reaches my place. I have been using this sediment on my fields with good results. Would it make good compost fertilizer?

H. G. Rowe,
Johnson City, Tenn.

It would be best to use this sediment in compost heaps, along with

plant material and smaller amounts of manure than would be used in the ordinary compost heap. You will also want to use lime or wood ashes.

April 4, 1942.

Your article on ARE FOOD CROPS FIT FOR HUMAN CONSUMPTION in the April issue of Fact Digest interests me very much as it confirms what I have preached all along.

In clearing water in front of some of my land on a lake I pulled out tons of common lake cat-tails. I am thinking of using them for compost. What do you think?

P. B. Gaass,
Crookston, Minn.

This should be doubly good for composting because anything that is under water is unusually rich with organic materials. Some day the government may reclaim millions of tons of seaweed and furnish it to farmers.

April 2, 1942.

It has often occurred to me that some sort of recovery could be made from our sewer systems and return that valuable material back to the soil. Would you care to comment on that phase of the subject.

Several years ago we had occasion to empty a septic tank and disposed of that material by pouring it around some young fruit trees. Some of it would be spilled in the process and those spots immediately grew lush with timothy grass in that field where all such grass had disappeared long before.

Very truly yours,
Ray C. Call,
Steubenville, Ohio.

This is a controversial subject. Many physicians who were contacted claim that there are certain very stubborn and harmful organisms in

human excrement that continue to live in spite of being buried in the earth as fertilizer and may infect persons who eat food grown in that manner. In Oriental countries it is quite a common practice.

In this country sewage is treated and the residue called "sludge" is used very much as fertilizer. But you are taking the same chance with this material. The policy of this magazine is to urge caution until the matter can be investigated. There is plenty of other organic materials available, however, so why take a chance?

March 24, 1942

I have fed forty head of cattle this year, and we carry out the practice of distributing a thin bed of straw each day over the cattle's quarters in the barn, leaving this pile up and cure all winter long, and are just now starting to take it out. Would you consider this good practice for the obtaining of natural fertilizer.

C. S. Weyandt,
Homer City, Pa.

The writer prefers to have the stables cleaned out once a week, and the manure placed in compost heaps immediately. This conserves fertilizing values and allows the mellowing process of composting to begin sooner. If you wait to do it all at one time, it becomes a big job taking lots of time and labor all at once. Dr. Ehrenfried Pfeiffer, head of the Bio-dynamic Farming movement in America says, however, that what you are doing is done sometimes in Bio-Dynamic practice. When the manure has heaped up to about one foot, a set of preparations is put in. This helps fermentation. In Spring this kind of manure except the upper layer of a few inches is ready for plowing under. The preparations may be obtained from Dr. Pfeiffer, Kimberton Farms, Kimberton, Pa.

ORGANIC FARMING AND GARDENING

March 25, 1942

I know it is a fact that our old homestead (of which I am still co-inheritor) has been ruined because the tenants have used commercial fertilizers—a something which my father always advised against. I can well remember as a boy that the spots or lighter or poorer soil on the old farm were rebuilt with manure which was a combination straw of various kinds including corn stalks and manure from the animals shed which was covered and nearly all boarded in. We had excellent crops and all healthy as children. I just make note of that to have you see how much better off we could have been with your natural composting, and also that you have a point of proof which the world needs badly.

John Finkle,
Detroit, Michigan.

April 3, 1942.

There is a point on which I am not clear.

All through your instruction it reads as if this compost heap were all made up at one time, and then after turning it, in 3 months' time it is ready for use.

It would then be necessary, in order to have it ready for the garden by the 1st or 15th of April, to start the compost heap by the 1st or the 15th of Jan.

Now at that time in the North, leaves, etc., are apt to be frozen solid, or if not and they could be shifted and made into a heap and moistened, and a cold snap followed, would not the subsequent freezing kill or retard the heating process, or the action of bacteria, or both? On the other hand if made up in the fall when leaves, etc., are plentiful, say in Oct. would not the process be finished by Jan. and the same thing happen, i.e. the freezing and delay? or the fact that they just lay dormant from Jan. on till used

in April, cause the heap to lose much of its virtue?

Then again, on the average place, there is material for a compost heap being made all the year round, not just at one time.

Table scraps, boquets, and a thousand and one things thrown out every day, not just at one specified time, say the 1st of Jan.

R. C. Towne, Ps. D.
Miami, Fla.

Regarding your question, you would have to start your heap, as you say, by the 1st or the 15th of January unless you happen to be in the North, when it would be impossible to have the biological action of the heap take place properly during the cold season. In the North a state of hibernation exists in the compost heap during freezing weather.

To use a compost heap in the North by spring, you would have to start it in the fall and if it should become ready before you are ready to use it, it would be best to place it under cover. There is no doubt that in the waiting process, some of the potency of the material is lost. The use of compost heaps in this country is in its infancy. No doubt, many ideas will be thought of and used and will be written about in this magazine.

The writer has been making compost heaps for only about eight months and I will say that my results have been a little disappointing, but I know that I have learned several tricks and during the coming year, I will get much better results. The same is true of almost any field of endeavor. It might be ideal if one could have two vegetable tracts, one that is being used and one that is being held in reserve, so that when the compost is ready, it could be plowed into the one that is being held in reserve. I do not know whether this is a practical idea, but I am giving it to you for all it is worth.

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TOBACCO DANGEROUS AROUND YOUNG TOMATO PLANTS

DAVIS, Calif., Mar. 4.—Use of tobacco in any form, cigarettes, cigars, snuff, or chewing, around tomato plant beds is the next thing to sabotage of the national drive for increased production of canning tomatoes, according to C. E. Scott, specialist in plant pathology in the University of California Agricultural Extension Service.

Scott explains that the virus of tobacco mosaic, a highly contagious disease of tomato plants, is often present in active form in smoking and chewing tobacco, and snuff. The disease can be carried on the hands of workers from the tobacco to the young plants.

Once the disease becomes established in the plant beds, Scott points out, it is easily spread by insects and by the handling necessary during transplanting. He recommends that any worker using tobacco should thoroughly wash his hands in laundry soap before handling plants.

LAWN AREAS UNFIT

An item that must not be overlooked is the use of lawn areas for vegetables. In this vicinity many lawns have been treated with arsenate of lead to control the Japanese beetle. These soils are at least temporarily unfit for growing peas and beans, and the arsenic may affect other vegetables as well.—*N. Y. Times*.

MINERALS IN WHEAT

Composting is a good idea when we realize that the mineral is in the stem and stock. A stock of wheat contains 67% of mineral while there is not even 1% in the kernel. It is necessary to have so much mineral in the stock to hold up the heavy head of grain, so you can readily see that if the straw is retained and composted there is very little loss to the land in necessary minerals.—J. H. McKenzie (Portland, Oregon).

RINGBARKING

"When you start ringing trees" (i.e., ringbarking), an old North Coaster told me, "the trees die. When the trees die, you get two bad results. One is soil erosion; the other is that you are evacuating the birds from the district, because birds live in trees."

Birds are the insecticide Nature used for a very long time to keep pests in their place.—*Man Magazine* (Australia).